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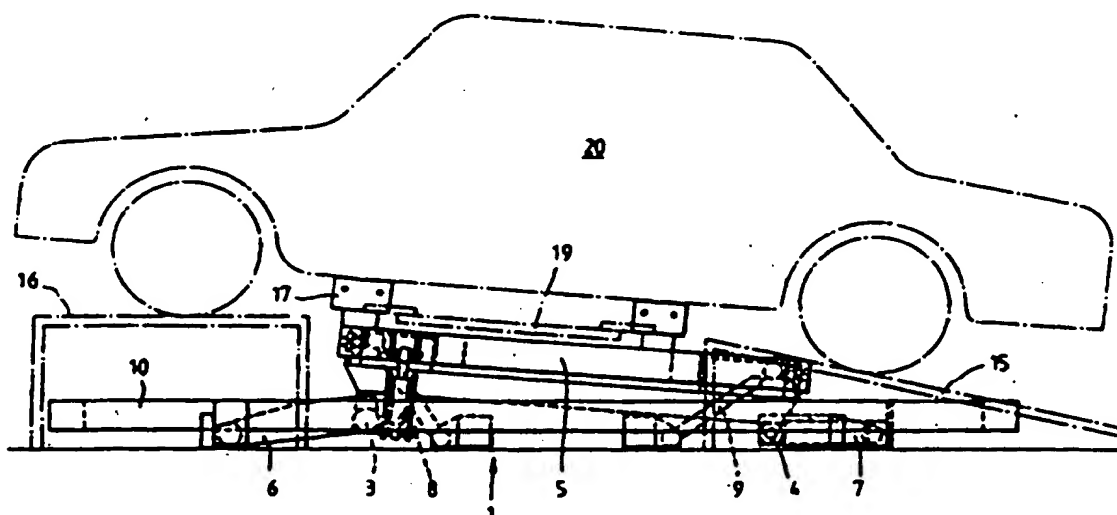
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950629 20 February 1995 (20.02.95) NO(71)(72) Applicant and Inventor: YRVUM, Gunnar, V. [NO/NO];  
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## (57) Abstract

A body alignment bench for small-size vehicles comprises a subframe (10) resting upon the surface, a movable mounting frame (5) to which the vehicle (20) may be secured and actuating means for moving the mounting frame (5), the mounting frame being connected to the subframe (10). The mounting frame (5) is pivotable in relation to an intermediate frame (13) about an axis (2) coinciding with or parallel to the longitudinal axis of the mounting frame; it is tiltable about a first transverse axis (3) located in one end area of the mounting frame; and it is also tiltable about a second transverse axis (4) located in the other end area of the mounting frame.

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## AUTO BODY REPAIR APPARATUS.

The present invention relates to a body alignment bench for passenger vehicles, comprising a subframe resting on the ground, a movable mounting frame onto which the vehicle may be secured, and actuating means for moving the mounting frame, the mounting frame being connected to the subframe and being tiltable about the longitudinal and transverse axis of the bench.

A body alignment bench or jig of this type is known from WO-87/07190 and WO-87/07191. These alignment benches are only capable of elevating the vehicle in its substantially horizontal position.

Norwegian Laid-Open Publication No. 149,834 disclose an apparatus for alignment operations and repair work on cars. The apparatus comprises a drive ramp having elevating means capable of vertical movement, the vehicle being supported by rocker panel supports when it is positioned upon the elevating means.

U.S. Patent 3,630,066 disclose a straightening apparatus consisting of lifting means and three or four columns having tensioning means. Also an inclined ramp for driving up a vehicle is provided. After the vehicle has been driven onto the apparatus, it is placed in a horizontal position.

European Patent Application EP-0,307,331 relates to a body alignment bench having a drive ramp and lift means, the front end of the alignment bench is pivotably mounted and its rear end may be raised by means of actuator cylinders.

European Patent Application EP 0,163,216 relates to a body alignment bench for vehicles where the vehicle is positioned on a turntable that is rotatable in the horizontal plane, and

a column having various movable arms which can be fixedly tied to the body of the car.

5 A lifting device of the type mentioned by way of introduction is also known from EP A-0,378,743. This lifting device is first and foremost adapted for placing a vehicle in a desired slant position or tilted position. Furthermore, the object of the lifting device is to avoid having a lifting column at each corner and thus to facilitate access to the  
10 various components of the vehicle. The total structure is, however, is of little rigidity, and, in opposition to the present alignment bench, it is rather unsuited for active alignment operations.

15 The presently proposed body realignment or alignment bench has many technical and ergonomic advantages when compared with the alignment benches on the market today. By maneuvering the alignment bench, it is possible to place the car in a very convenient work position. The alignment bench is  
20 particularly advantageous when used together with a pulling machine which makes it possible to apply the versatile movement functions of the apparatus to the rough part of body alignment work. This is quite different from previously known jig arrangements.

25 Thus, it will be possible to raise the front part of the vehicle, optionally the rear part of the vehicle, or one side or the other, optionally a corner. The alignment bench is constructed in such a way that it is 100% stable in all  
30 positions and has no problems in withstanding the heavy loads to which a body alignment bench normally is exposed. The versatility of the alignment bench also makes it well suited as a conventional lifting device for carrying out mechanical work, such as overhaul of brakes.

35 By means of the completely independent maneuvering of a vehicle on the alignment bench, the vehicle can be placed in

any desired position, both for working purposes and in connection with a pulling machine. The maneuverability of the alignment bench in combination with its stability and use of great force makes it particularly suitable for body alignment work.

The above advantages are achieved by means of a body alignment bench of the type mentioned by way of introduction, characterized in that the mounting frame is connected to the subframe via an intermediate frame, the mounting frame is attached to the intermediate frame and is tiltable about an axis coinciding with or parallel to the longitudinal axis of the mounting frame, the intermediate frame is pivotable about a first transversal axis located in one end area of the intermediate frame and the intermediate frame is pivotable about a second transversal axis located in the other end area of the intermediate frame.

It is expedient that the intermediate frame be connected to the subframe via pivotable link mechanisms, one at each end of the intermediate frame. One link mechanism is pivotably fixed in relation to the subframe and the other link mechanism is pivotable and displaceable along the subframe.

It is expedient that the mounting frame be pivotable about its longitudinal axis by means of at least one actuating cylinder operating independently of the subframe.

It is expedient that at least one actuating cylinder be mounted between the subframe and the intermediate frame in each end area for operating the intermediate frame about said transverse axes.

Preferably, a pulling machine is releasably attached to the subframe in order to carry out straightening operations by means of the maneuverability of the mounting frame.

The alignment bench is positioned on the floor via the subframe. Optionally, the subframe may be secured to the floor. The mounting frame may, as indicated, be maneuvered across three axes, tilting both ways in its longitudinal direction at the same time as it can be tilted in both lateral directions, as well as up and down. The mounting frame may, for example, have a lifting force of 140,000 N and a downward pulling force of about 90,000 N, since the actuating cylinders have dual functions. The torque moment for the lateral movements is about 45,000 Nm.

The alignment bench may be maneuvered by means of a hydraulic/electrical system and be controlled by a simple electric hand panel. Measuring equipment may be mounted on the mounting frame, moving with the mounting frame and the movements of the vehicle. The mounted measuring equipment does not interfere with the functions of the body alignment bench.

Other, additional objects, features and advantages will be apparent from the following description of a preferred embodiment of the invention, provided for the purpose of description without thereby being restrictive, and in connection with the enclosed drawings wherein:

Fig. 1 shows schematically a side view of the body alignment bench according to the invention,

Fig. 2 shows the alignment bench according to Fig. 1, seen from above,

Fig. 3 shows the alignment bench according to Fig. 1 seen from the front,

Fig. 4 shows the alignment bench seen from the side and having the mounting frame and the intermediate frame partly raised in its front end area,

Fig. 5 shows the alignment bench according to Fig. 4 having the mounting frame removed and the intermediate frame raised in both end areas,



Fig. 6 shows the alignment bench according to Fig. 4 having the mounting frame and the intermediate frame lowered in the front area and raised in the rear end area, and

5 Fig. 7 shows the mounting frame and the intermediate frame according to Fig. 4 seen from the front.

An embodiment of the body alignment bench according to the invention will now be described with reference to the  
10 enclosed drawings. Fig. 1 shows a vehicle 20 placed on the body alignment bench 1. The vehicle 20 may be driven up on the alignment bench 1 by means of inclined ramps 15 and support means 16 and tracks 19 located therebetween. These may be removed after the vehicle 20 has been placed on the  
15 alignment bench 1.

The alignment bench 1 consists of a subframe 10 placed on the ground or a floor. Although not strictly necessary, the subframe may be fixed to the floor. The alignment bench also  
20 comprises a mounting frame 5 to which the vehicle 20 is secured by means of clamping devices 17. If no body alignment operation is to be carried out these clamping devices 17 may be replaced by support pads upon which the vehicle 20 merely rests without being tied down. The mounting  
25 frame 5 is connected with the subframe 10 via an intermediate frame 13.

The subframe 10 is stationary, whereas the mounting frame 5 is maneuverable about three axes. The mounting frame 5 is  
30 tiltable about an axis 2 running in the longitudinal direction of the mounting frame. This axis is denoted in Figs. 3 and 7. Two actuators or actuating cylinders 8 carry out this tilting movement of the mounting frame 5 about the axis 2, which thus brings about the tilting movement of the  
35 vehicle 20 in the lateral direction. The lateral movements are indicated in particular in Fig. 3. As apparent from the drawing the tilting angle is relatively limited, being in the

magnitude range of  $10^0$  in relation to the horizontal plane in both directions.

Fig. 2 shows from above the body alignment bench having transverse beams 11 secured to the mounting frame 5. The transverse beams 11 have clamping devices 17, optionally said support pads, mounted thereon. The drawing also shows a pulling machine 12 which is attached to the subframe 10. The pulling machine 12 may be attached to any area around the whole subframe 10, as needed. Otherwise, the pulling machine 12 is of a completely conventional design and will not be further described here.

Figs. 4, 5 and 6 show the maneuverability of the intermediate frame 13 in a vertical direction. Two actuating cylinders 9 carry out the elevation of the intermediate frame 13 in its respective end areas. In the front end area of the intermediate frame 13 (to the left in Figs. 4, 5 and 6) the intermediate frame 13 is connected to the subframe 10 by means of a link mechanism 6. The link mechanism 6 is rotatably connected to the subframe 10 in one end or its lower end area. In its other or upper end area the link mechanism 6 is pivotably attached to the intermediate frame 13 by means of a shaft or trunnion which forms a first transverse axis 3 about which the intermediate frame 13 can pivot. In the other end area of the intermediate frame (to the right in Figs. 4, 5 and 6) an additional link mechanism 7 forms a connection between the intermediate frame 13 and the subframe 10. The link mechanism 7 is pivotably connected to the subframe 10 in one end or its lower end and is in addition displaceable in the longitudinal direction of the subframe 10. The link mechanism 7 is in its other or upper end pivotably attached to the intermediate frame 13 by means of a rotatable shaft or trunnion which forms a second transverse axis 4 about which the intermediate frame 13 can pivot. It will thus be understood that the maneuverability of the intermediate frame 13 and the mounting frame 5, illustra-

ted in Figs. 4, 5 and 6, is achieved by actuating one or both cylinders 9. Either one end area or the other end area may be elevated; optionally both end areas may be elevated to lift a vehicle horizontally. As apparent from Figures 4, 5 and 6, this pivotable movement is relatively limited, in the order of magnitude of  $10^{\circ}$  in relation to the horizontal.

Nevertheless, when these pivoting movements about the transverse axes are combined with the tilting movements about the longitudinal axis 2, a surprisingly high lift is obtained for a corner of the vehicle. It is also this maneuverability in several directions which makes the alignment bench so well suited for carrying out body straightening operations.

The mounting of the vehicle 20 is simple and quick since the vehicle can be driven up or be pulled onto with a winch. The alignment bench 1 is low in the drive-up or mounting position, measuring, for example in a constructed prototype, 480 mm in front and 325 mm at the back. An inclination of  $5^{\circ}$  entails that very little force is needed to get the car onto the bench. Securing the car is also quick since the mounting frame is elevated underneath. The lateral tilting makes it possible to secure one side of the car at a time. The usual mounting problems are therefore eliminated. Securing clamps are, as on all other alignment benches, provided with special features for individual car types. The driving ramps will automatically be fixedly locked, but may be removed, as needed, by simple manipulation.

The body alignment bench may, as indicated, be placed freely on the floor, but if fixedly mounted thereon it will provide even greater functional benefits. The alignment bench will also function as ordinary lifting means and can with advantage be used also in connection with repairs of, for example, motors and in the mounting and dismantling of the front suspension or rear end of the car.

When not in use, ordinary body alignment benches are often an obstacle to the work in the repair shop whereas the present alignment bench will also readily serve as a versatile "work bench" for cars.

As apparent from Fig. 5, two brackets 14 absorb the axial forces in both directions between the mounting frame 5 and the intermediate frame 13. Further, the bracket 18 and the link 6 absorb the axial forces between the intermediate frame 13 and the subframe 10. The width of the link mechanisms 6 and 7 and the strong bearings of the subframe 10 and the intermediate frame 13 absorb forces in the transverse direction.

As illustrated in Figs. 5 and 7, the body alignment bench may be equipped with a safety device which automatically locks the bench in an upper or approximately fully raised position. The shown embodiment of a safety device comprises at least one locking rod 30 which in its upper end is rotatably mounted in the bracket 14 and may be rotated about the same axis as the cylinder 9. The other or lower end of the locking rod 30 slides or rolls on a ramp surface 32 placed on a bracket 31 which may also form a part of the lower attachment to the subframe 10 for the actuating cylinder 9.

When the intermediate frame 13 is completely lowered, the locking rod 30 is primarily in a horizontal position. As the intermediate frame 13 is raised, the locking rod 30 pivots down and slides on the bracket 31. This movement can occur reversibly until a certain height of the intermediate frame 13 is achieved. At this predetermined height the lower end of the locking rod 30 slides across a sill 33 and irreversibly down the ramp surface 32 and locks the intermediate frame 13 in this raised position. In order to release the intermediate frame 13 once more, it must be raised

somewhat and the locking rod or rods 30 be pivoted back across the sill 33, whereupon the frame 13 can be lowered.

5 All bearings are given large dimensions in order to withstand the heavy loads to which an alignment bench normally is exposed. This is important for achieving 100% stability and avoiding play in those parts which are joined together.

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P a t e n t   C l a i m s

1.

A body alignment bench for vehicles, comprising a subframe  
5 (10) resting on the ground, a movable mounting frame (5)  
onto which the vehicle (20) may be secured and actuating  
means for moving the mounting frame (5), the mounting frame  
being connected to the subframe (10) and being tiltable about  
the longitudinal and transversal axis of the bench,  
10 c h a r a c t e r i z e d i n that the mounting frame (5)  
is connected to the subframe (10) via an intermediate frame  
(13), that the mounting frame (5) is attached to the inter-  
mediate frame (13) and is tiltable about an axis (2) coin-  
ciding with or parallel to the longitudinal axis of the  
15 mounting frame, that the intermediate frame (13) is pivotable  
about a first transversal axis (3) located in one end area of  
the intermediate frame and that the intermediate frame (13)  
is pivotable about a second transversal axis (4) located in  
the other end area of the intermediate frame.

20

2.

A body alignment bench according to claim 1,  
c h a r a c t e r i z e d i n that the intermediate frame  
(13) is connected to the subframe (10) via pivotable link  
25 mechanisms (6, 7), one at each end of the intermediate frame.

3.

A body alignment bench according to claim 2,  
c h a r a c t e r i z e d i n that one link mechanism (6)  
30 is pivotably fixed in relation to the subframe (10) and the  
other link mechanism (7) is pivotable and displaceable along  
the subframe (10).

4.

35 A body alignment bench according to one or more of claims  
1-3.

c h a r a c t e r i z e d i n t h a t t h e m o u n t i n g f r a m e ( 5 )  
i s t i l t a b l e a b o u t t h e l o n g i t u d i n a l a x i s ( 2 ) b y m e a n s o f a t  
l e a s t o n e a c t u a t i n g c y l i n d e r ( 8 ) o p e r a t i n g i n d e p e n d e n t l y o f  
t h e s u b f r a m e ( 1 0 ).

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5.

A b o d y a l i g n m e n t b e n c h a c c o r d i n g t o o n e o r m o r e o f c l a i m s  
1-4,

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c h a r a c t e r i z e d i n t h a t a t l e a s t o n e a c t u a t i n g  
c y l i n d e r ( 9 ) i s m o u n t e d b e t w e e n t h e s u b f r a m e ( 1 0 ) a n d t h e  
i n t e r m e d i a t e f r a m e ( 1 3 ) i n e a c h e n d a r e a f o r o p e r a t i n g t h e  
i n t e r m e d i a t e f r a m e ( 1 3 ) a b o u t s a i d t r a n s v e r s e a x e s ( 3 , 4 ).

6.

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A b o d y a l i g n m e n t b e n c h a c c o r d i n g t o o n e o r m o r e o f c l a i m s  
1-5,

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c h a r a c t e r i z e d i n t h a t a p u l l i n g m a c h i n e ( 1 2 )  
i s r e l e a s a b l y a t t a c h e d t o t h e s u b f r a m e ( 1 0 ) f o r c a r r y i n g o u t  
s t r a i g h t e n i n g o p e r a t i o n s b y m e a n s o f t h e m a n e u v e r a b i l i t y o f  
t h e m o u n t i n g f r a m e ( 5 ).

7.

A b o d y a l i g n m e n t b e n c h a c c o r d i n g t o o n e o r m o r e o f c l a i m s  
1-6,

25

c h a r a c t e r i z e d i n t h a t t h e b e n c h c o m p r i s e s a  
s a f e t y d e v i c e ( 3 0 , 3 1 , 3 2 , 3 3 ) w h i c h l o c k s t h e m o u n t i n g  
f r a m e ( 5 ), o r t h e i n t e r m e d i a t e f r a m e ( 1 3 ), i n a r a i s e d  
p o s i t i o n .

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 96/00034

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B66F 7/22 // B21D 1/12

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B66F, B21D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 8707190 A1 (AUTOROBOT FINLAND KY), 3 December 1987 (03.12.87) --	1-7
A	EP 0378743 A1 (ROSSATO, E.), 25 July 1990 (25.07.90) --	1-7
A	NO 149834 B (T.O. VENÄLÄINEN), 26 March 1984 (26.03.84) -----	1-7

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Date of the actual completion of the international search

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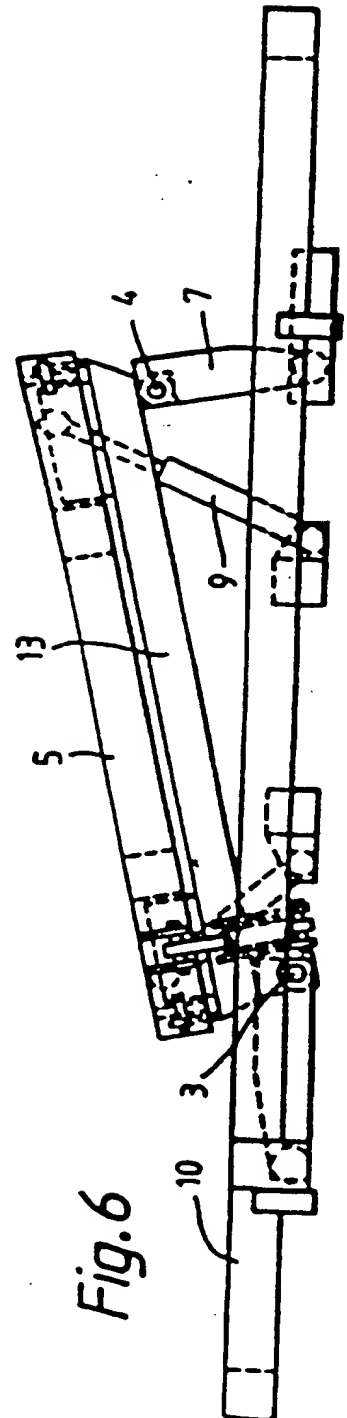
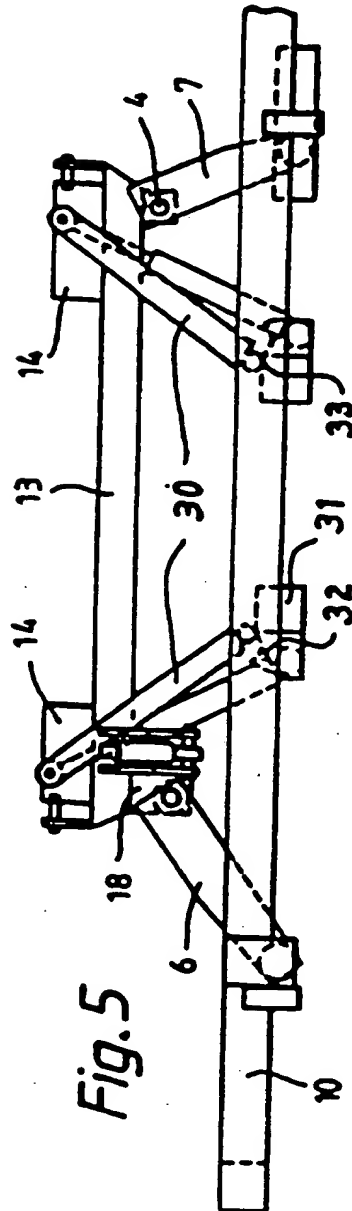
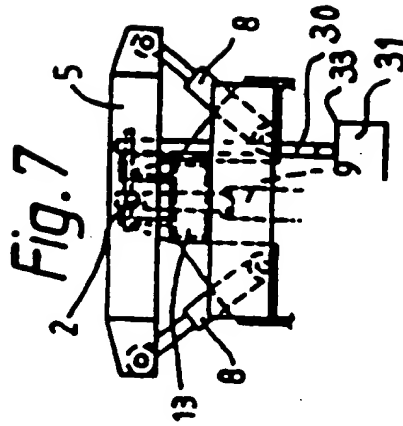
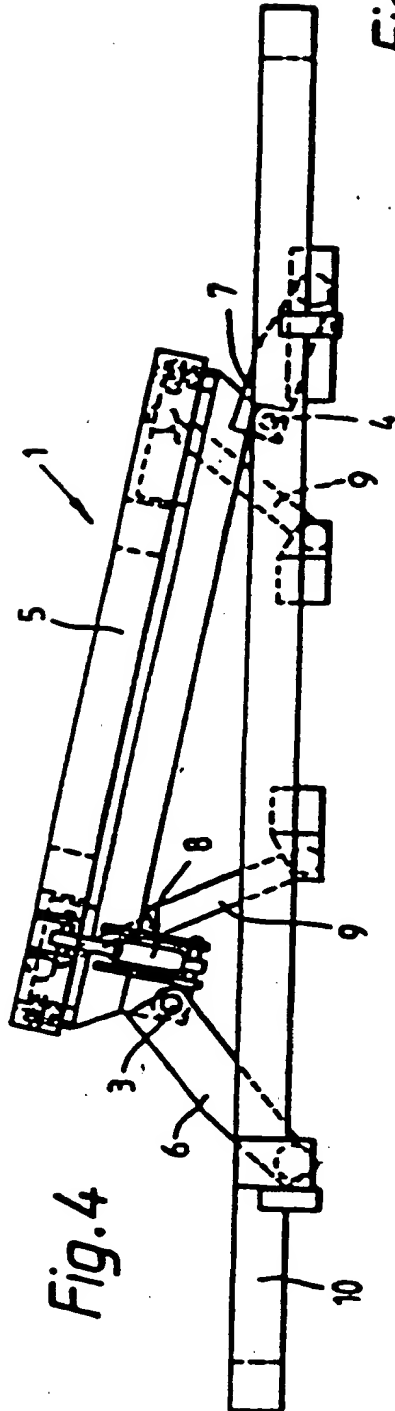
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Information on patent family members

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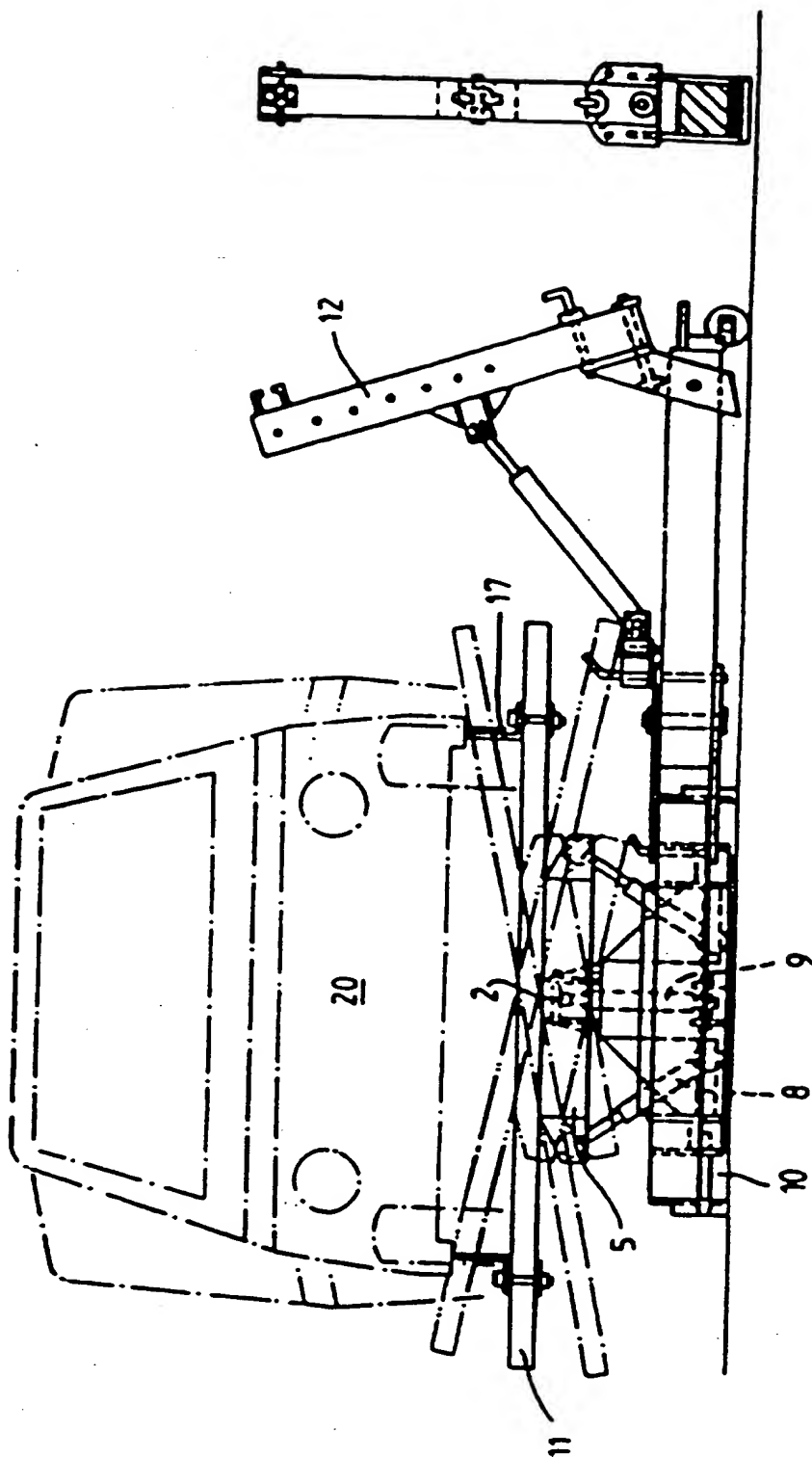
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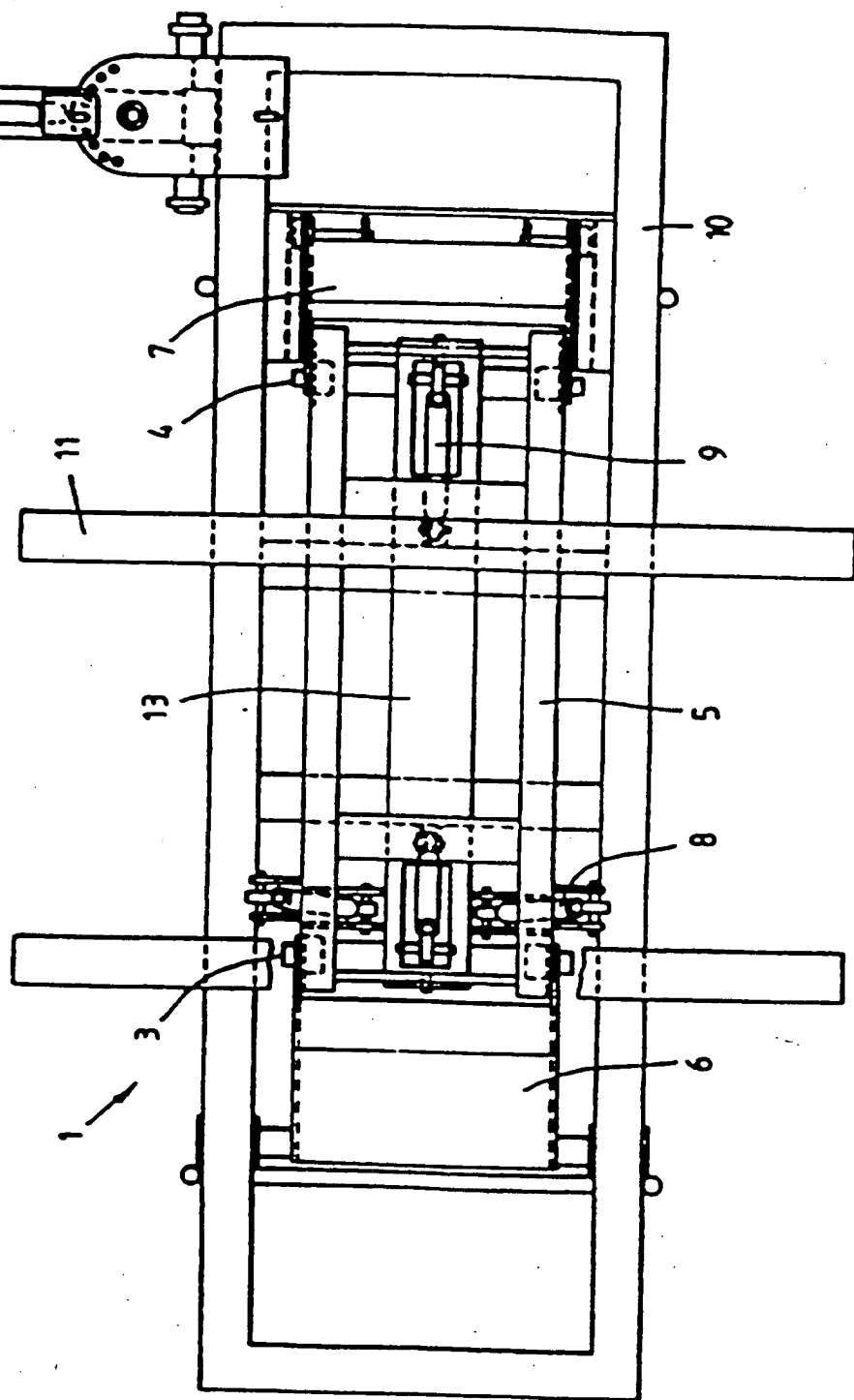
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Fig. 3



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Fig. 2



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Fig.1

